STāSIS – Dynamometer Testing & Data Reduction Methods

General Description

The aim of this whitepaper is to inform the reader of the methods STāSIS engineers employ when conducting dynamometer testing as well as data reduction for marketing materials. Dynamometers are a complex engineering tool. As such they must be operated with care especially with regards to procedure and data analysis. Many variables can affect the results of dynamometer testing. This paper will discuss some of the main issues faced with testing the power of a vehicle as well as how they are addressed by STāSIS. It is assumed that the reader has a basic knowledge of dynamometers and their function.

STāSIS can be defined as a condition of balance among various forces and that is the driving force behind our unique engineering approach. Drawing on years of motorsport and engineering experience the STāSIS team develops a range of products for a vehicle that work harmoniously together.

Dynamometer Testing

STāSIS conducts testing with an all-wheel dynamometer produced by Dynapack. The Dynapack system has proven to be highly repeatable. One reason for this is because it measures power at the vehicles hub and not at the tire as do roller based dynamometers. The friction from the tire to roller interface causes a power loss which can be non-linear with respect to wheel speed. It is difficult to accurately account for these loses, especially because they are affected by the tires internal pressure as well as any loading forces applied by strapping the vehicle down for testing. Both of these variables are eliminated with hub based systems.

Airflow is crucial for a vehicles performance regardless of its use. During dynamometer testing, air handling is critical for accuracy and repeatability because the vehicle is stationary. When traveling on the road, the air intake tract receives a large volume of air. Another point commonly overlooked is the air traveling through the radiators and around the engine. If this airflow cannot be provided during testing, engine components can saturate with heat not indicative of actual operation and skew results. STāSIS utilizes a high flow, temperature monitored fan system capable of matching the actual airflow the vehicle needs.

It is important to realize that just like an automobile a dynamometer is a dynamic system. The behavior of the system is affected by its surroundings and operation. To achieve repeatable results, STāSIS performs several test runs to warm the dynamometer components to their steady state operating temperature. Once the dynamometer is prepared and atmospheric conditions are adequate, several sessions of a given test configuration are logged for data reduction.

Data Reduction

After dynamometer testing is complete the data must be processed in order to validate results. First the average of multiple runs of a stock configuration is taken. Then this data is corrected to match the factory published crankshaft power data. Next the average of multiple runs of the modified configuration is taken and the same correction is applied. This yields a data plot showing the STāSIS modified power versus the stock power as seen at the crankshaft. Corrections are calculated for every vehicle tested as it is not accurate to assume a set percentage for parasitic losses. Losses are non-linear. If a constant percentage of loss is applied to the data set the power at low engine speed could be underrated and the power at high engine speed could be overrated.